Appendix A

Model Construction Site Geometry

Introduction

A suite of model construction site geometries were developed to represent the population of construction sites in order to estimate costs and pollutant load reductions for the regulatory options developed. A total of 24 model sites were developed consisting of a combination of six site sizes (0.5, 3, 7.5, 25, 70, and 200 acres) and four land uses (single family residential, multifamily residential, commercial, and industrial). These model sites were developed in order to take into consideration the following factors:

Drainage Pathways and Watershed Size. The national average watershed size was determined for different stream orders to delineate drainage pathways for different site sizes and to estimate the associated BMP sizes. These factors were needed in order to calculate the costs of BMPs and to model the pollutant removal efficiency of BMPs under the various regulatory options considered.

Site Imperviousness. Typical amounts of ultimate impervious and pervious areas for the land uses were determined in order to estimate the likely extent of disturbed acreage for each site size and land use.

Within each site model three flow paths were defined:

1. disturbed areas that drain to a centralized point;
2. undisturbed areas that drain to a centralized point; and
3. perimeter drainage (assumed to be disturbed).

Based on geometry, the model sites dictate the size, number, and type of BMPs employed, under baseline and regulatory options. Each potential regulatory change was evaluated to assess how the model site BMP configuration would change, so that pollutant loading reductions and costs could then be assessed.

Small Model Construction Sites (Less than 10 acres)

Three construction site models were created to represent small construction sites within the following size ranges:

1. 0 to 1 acre;
2. 1 to 5 acres; and
3. 5 to 10 acres.

These groups were each represented by single model site, which were 0.5, 3, and 7.5 acres, respectively. A site model was created for sites smaller than 1 acre in size, although none of the options affected sites of this size. These sites were included in the analyses in order to account for their pollutant loadings.

The first step of the analysis was to assume the placement of site models relative to first order watersheds. A low-end estimate of first order watershed size was based on EPA's review of topography found in approximately 2 million acres dispersed in the contiguous states. Using a low-end estimate tends to increase the number of erosion control BMPs installed (i.e., sediment traps and sediment basins), but does not increase the storage volume of these BMPs which originate solely from the acreage served (e.g., 3,600 cubic per acre). Note that the size of the first-order watershed has no influence on the number of other BMPs (e.g., inlet protection, rock check dams, seeding/mulch) within EPA's model sites.

Figure A-1 illustrates the assumed location of three small site models within first-order watersheds. Fitting the model site within a first order watershed is important because it helps set the presence of drainage features, such as first order streams. Table A-1 lists the assumed quantities of BMPs for the small construction site models. Figures A-2 through A-4 illustrate the geometry of these BMPs in relation to the small construction site models.

For the 0.5- and 3-acre models, sites were placed wholly within one first-order watershed. For the 7.5 acre model, sites were placed across two watersheds, reflecting that larger sites may cross major drainage divides. This means that approximately half the construction site runoff is assumed to flow to the left (on Figure A-4), and the other half flows to the right. As a result, this site size category would require two sediment controls (i.e., sediment traps) to serve the total central drainage acreage.

Figure A-3 illustrates EPA's approach to perimeter drainage, i.e., the area of the construction site that drains away from the site as sheet flow. For this site size model, EPA assumed that perimeter drainage controls would be required on three of the four sides of the rectangular site. The fourth side is on the uphill side of the site, and would drain centrally into natural and man-made swales/pipe systems.

Table A-2 indicates changes in BMPs expected for the small construction site models in response to the regulatory options.

Figure A-1. Placement of Small Construction Sites Within First-Order Watersheds

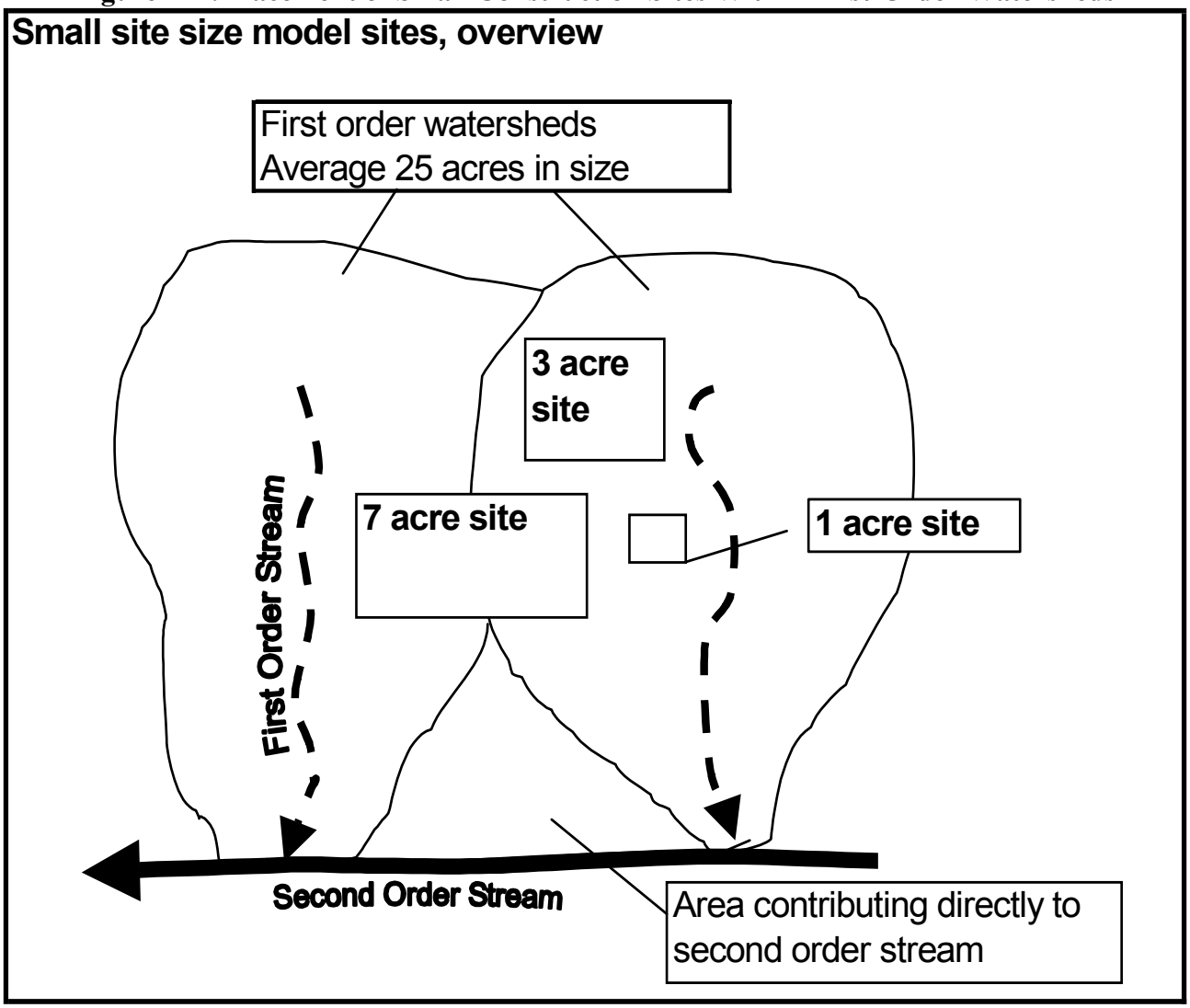

Table A-1. Small Construction Site Model BMP Parameters

BMP	0.5 Acre Model Sites	3 Acre Model Sites	7.5 Acre Model Sites
Silt Fence (miles)	0.09	0.20	0.50
Seeding and Mulching (acres)	Varies based on land use		
Rock Check Dams (number)	0	0	2
Sediment Traps (number)	0	0	2
Sediment Basins (number)	0	0	0
Inlet Protection (number)	2	3	6
Installation Certification (number)	0	1	2
E&S Site Inspection (number)	1	1	1

Figure A-2. 0.5 Acre Model Construction Site Geometry

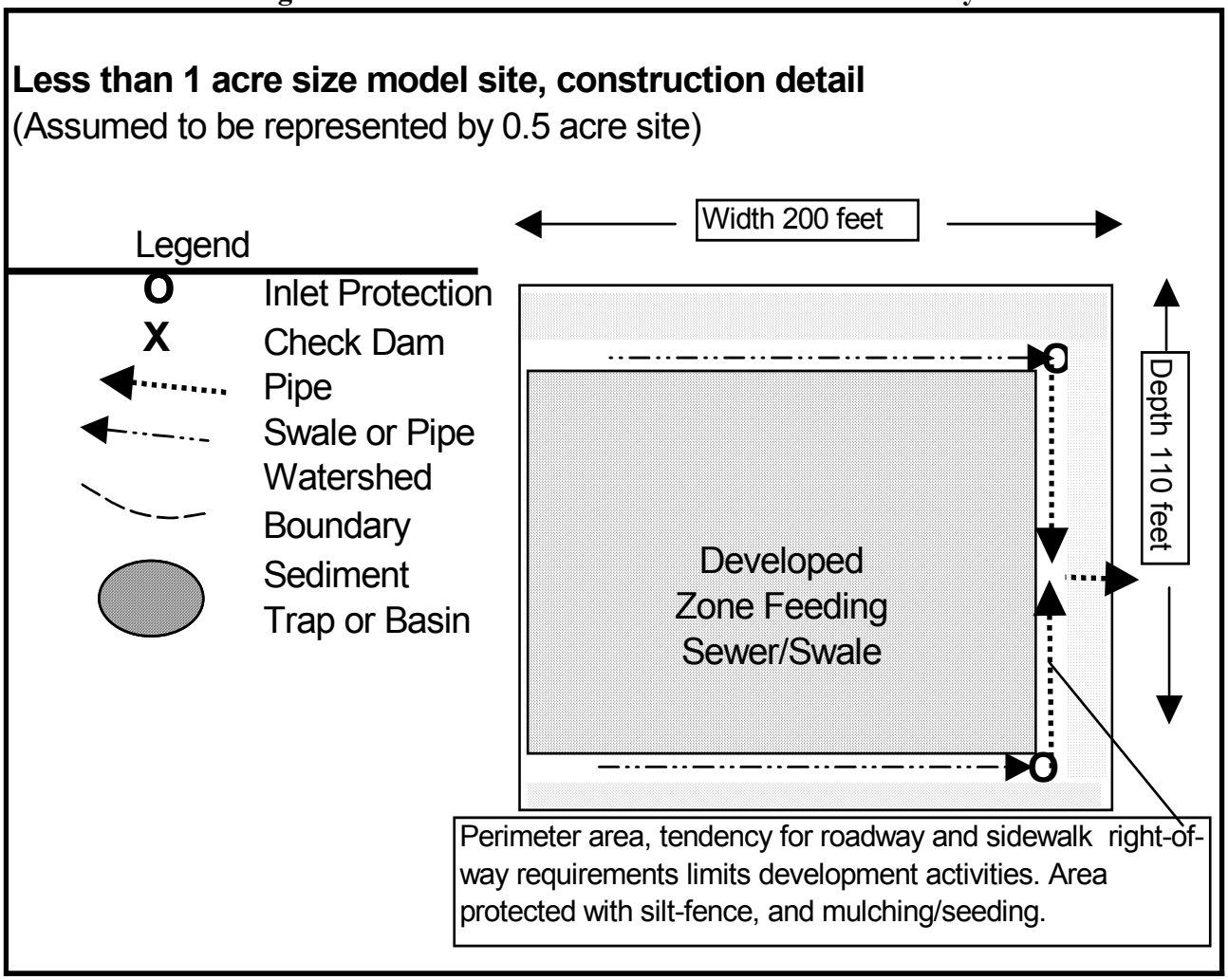

Figure A-3. 3 Acre Model Construction Site Geometry

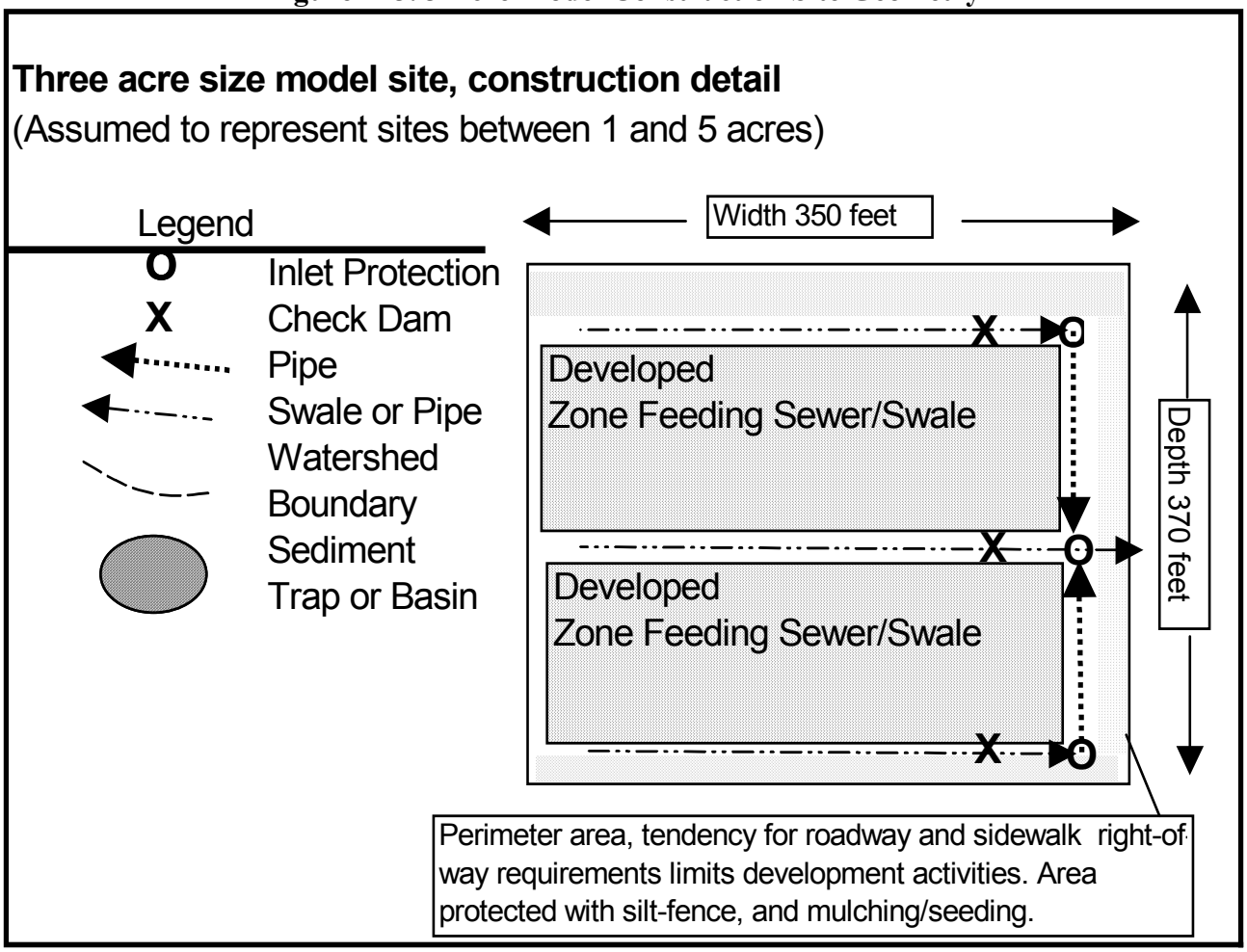

Figure A-4. 7.5 Acre Model Construction Site Geometry

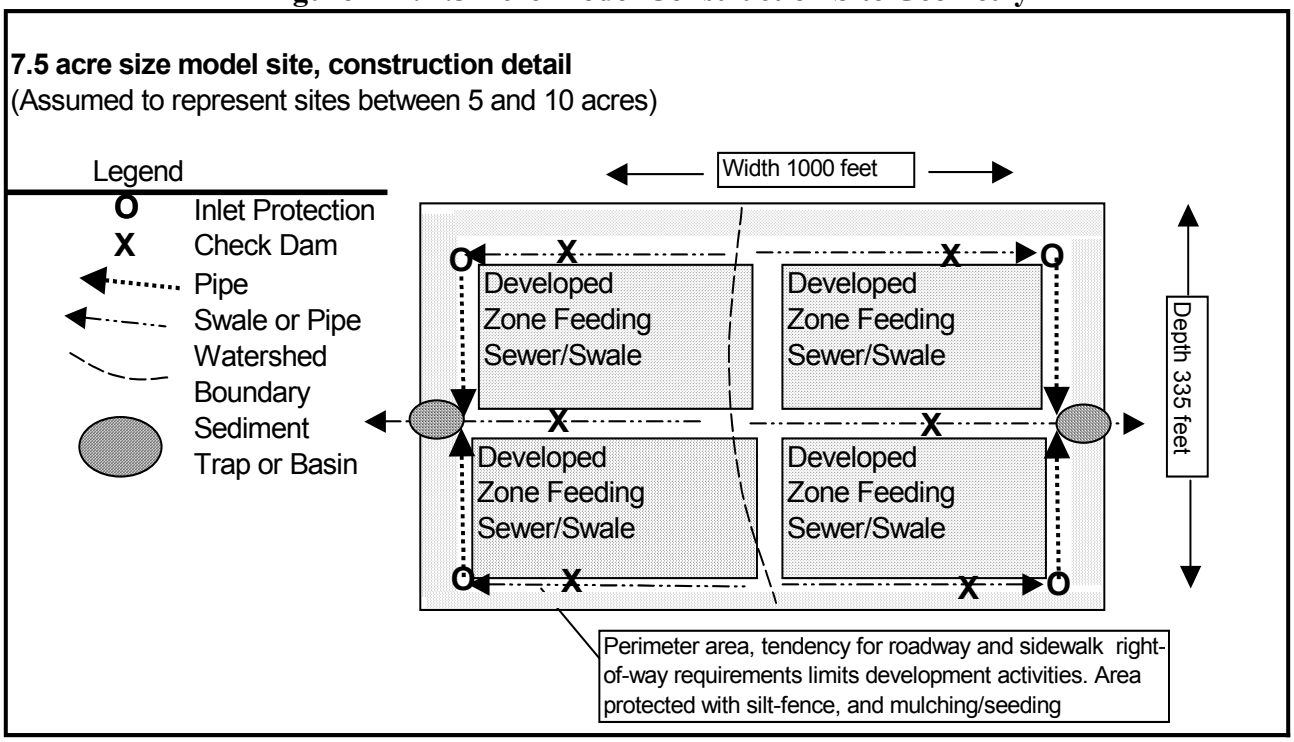

Table A-2. Small Model Construction Site Changes Due to Regulatory Options

Regulatory Option	BMP Changes over Baseline
0.5 Acre Model Sites	
Option 1	No change
Option 2	No change
Option 4	No change
3 Acre Model Sites	
Option 1	Certification of installation of BMPs required for all sites
Option 2	No change
Option 4	No change
7.5 Acre Model Sites	
Option 1	Certification of installation of BMPs required for all sites
Option 2	Sediment traps and installation certification would be required for all sites
Option 4	Sediment traps would be required for all sites.

Construction Site Models for 10 to 40 acres Sites

Sites within the range of 10 to 40 acres were represented by a model construction site of 25 acres. Figure A-5 illustrates placement of this model site within watersheds. The assumed rectangular site was placed overlapping the border between two first order watersheds. As detailed in Figure A-6, this means that site drainage goes in three possible directions, including a portion of the site that flows directly into a second order stream. As a result, this site size category would require two sediment basins to serve the two central drainage areas.

Table A-3 indicates the quantities and types of BMPs assumed for the 25 acre site model. Table A-4 indicates the changes in BMPs expected for this model site as a result of the regulatory options.

Figure A-5. Placement of 25 Acre Model Sites Within Watersheds

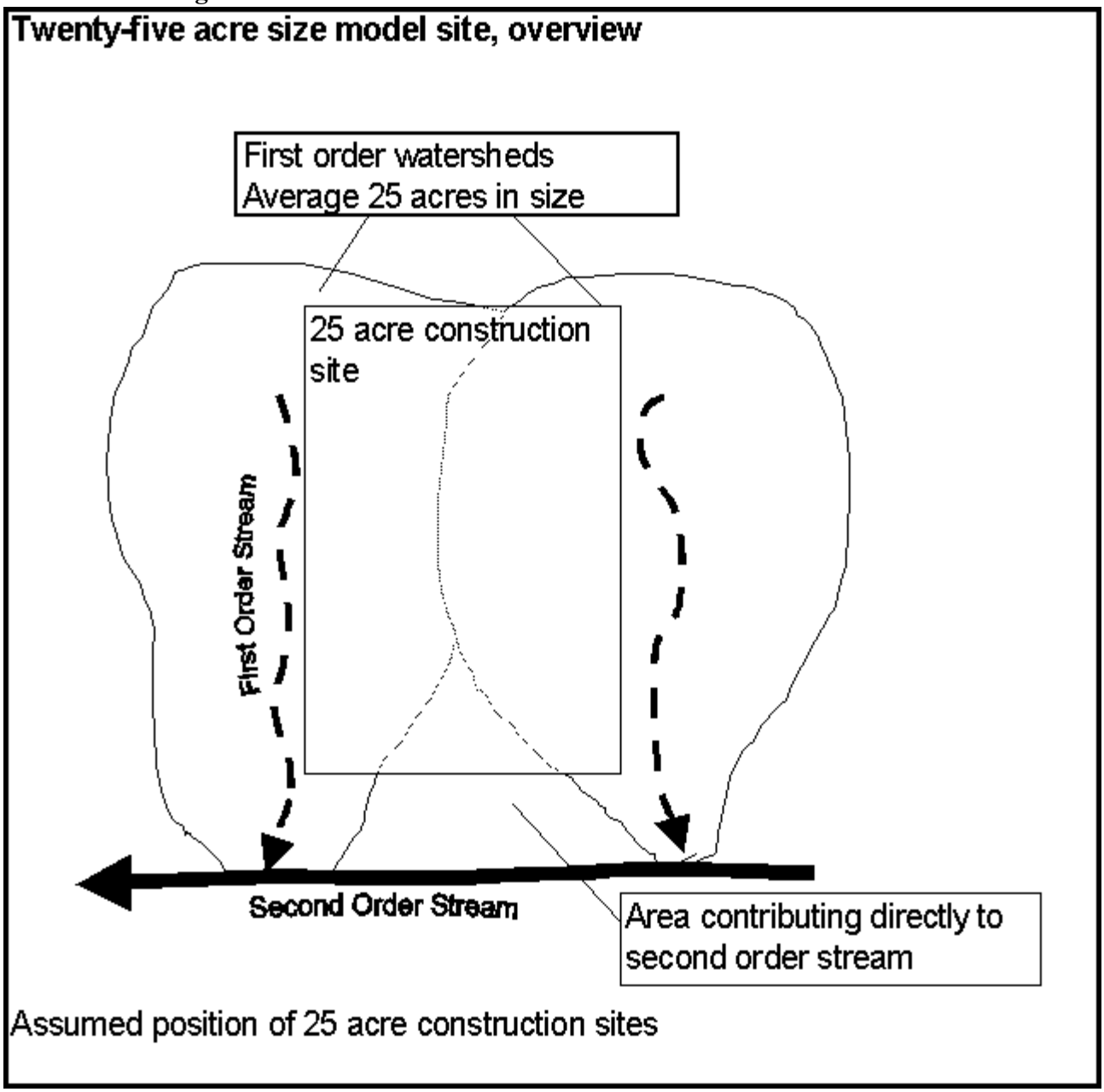

Figure A-6. 25 Acre Model Construction Site Geometry

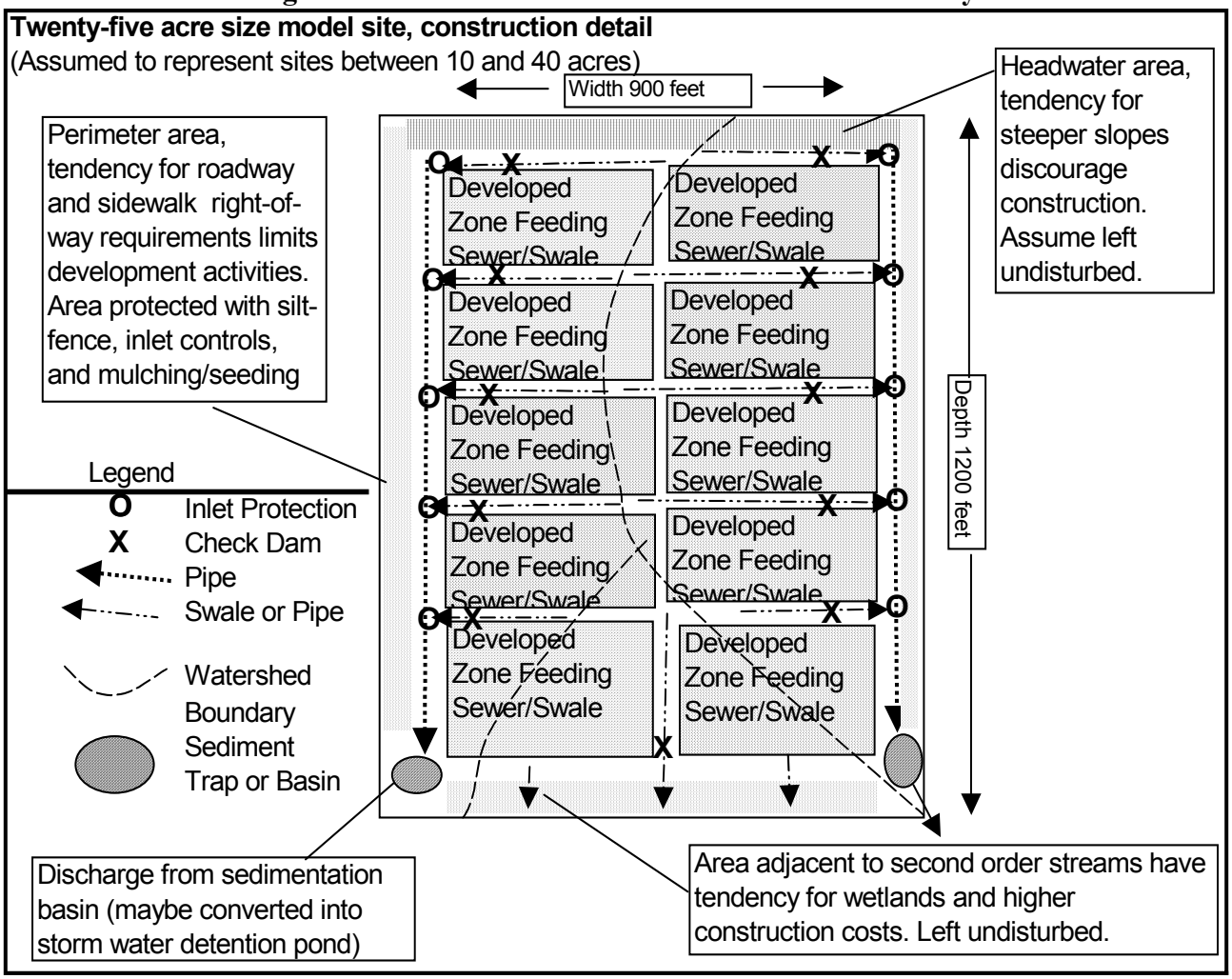

Table A-3. 25 Acre Construction Site Model BMP Parameters

BMP	Quantity
Silt Fence (miles)	0.63
Seed and Mulch (acres)	Varies between 62% to 84% of site area
Rock Check Dams (number)	11
Sediment Traps (number)	0
Sediment Basins (number)	2
Inlet Protection (number)	10
Installation Certification (number)	5
Site Inspection (number)	2

Table A-4. 25 Acre Model Construction Site Changes Due to Regulatory Options

Regulatory Option	BMP Changes over Baseline
Option 1	Certification of installation of BMPs required for all sites
Option 2	Larger sediment basins and installation certification would be required for all sites
Option 4	Larger sediment basins would be required

Construction Site Models for 40 to 100 acres Sites

Sites within the range of 40 to 100 acres were represented by a model construction site of 70 acres. Figure A-7 illustrates placement of this model site within watersheds. The assumed rectangular site overlaps three first order watersheds, dividing the site into areas with different discharge points. As detailed in Figure A-8, this means that site drainage goes in five possible directions, including two portions of the site that flow directly into a second order stream. As a result, this site size category would require three sediment basins to serve the three areas that drain centrally but independently. In addition, there are border areas that drain through perimeter controls and open (undisturbed) areas where development would likely be limited by floodplain issues.

Table A-5 indicates the quantities and types of BMPs assumed for the 70 acre site model. Table A-6 indicates the changes in BMPs expected for this model site as a result of the regulatory options.

Figure A-7. Placement of 70 Acre Model Sites Within Watersheds

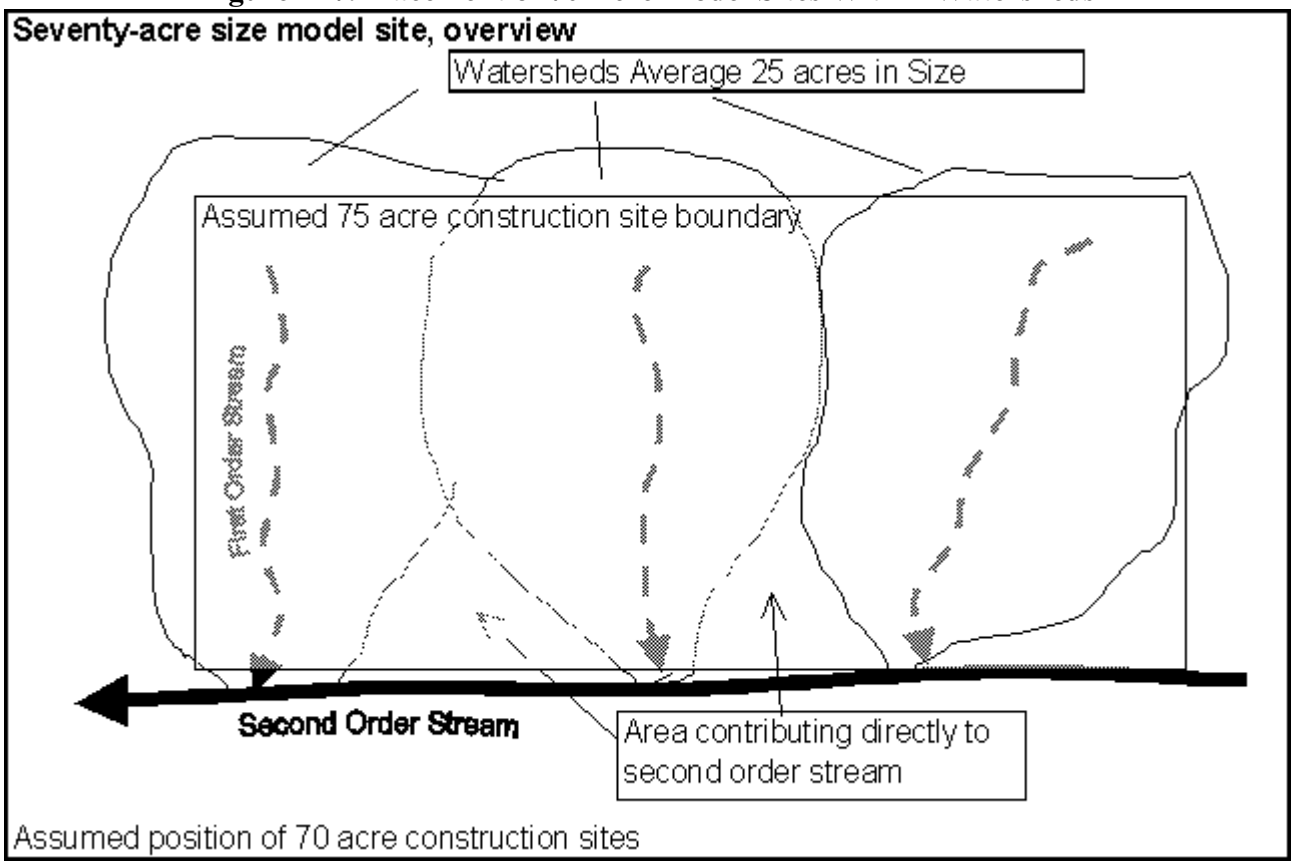

Figure A-8. 70 Acre Model Construction Site Geometry

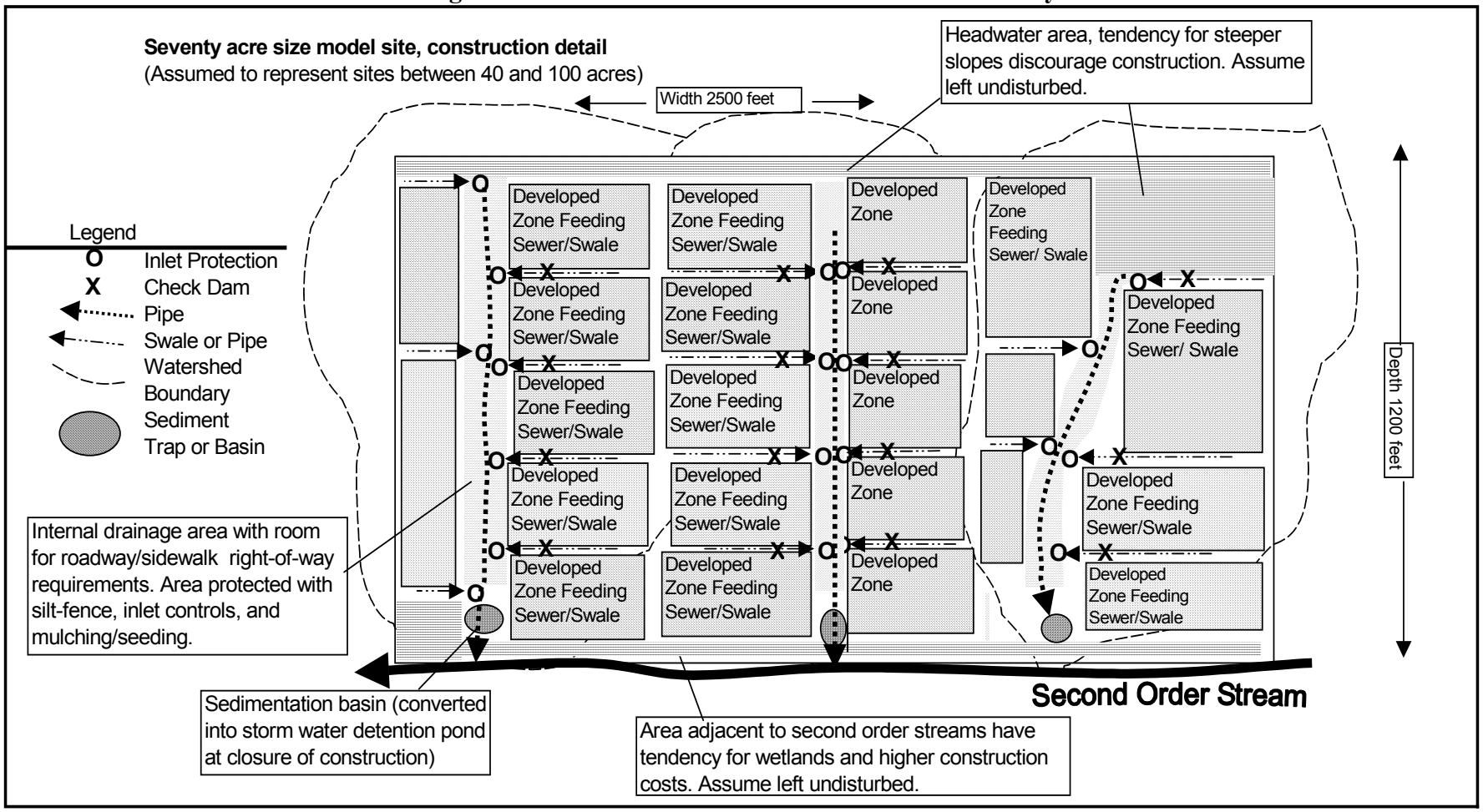

Table A-5. 70 Acre Construction Site Model BMP Parameters

BMP	Quantity
Silt Fence (miles)	1.36
Seeding and Mulching (acres)	Varies between 62% to 84% of site area
Rock Check Dams (number)	20
Sediment Traps (number)	0
Sediment Basins (number)	3
Inlet Protection (number)	20
Installation Certification (number)	10
E&S Site Inspection (number)	7

Table A-6. 70 Acre Model Construction Site Changes Due to Regulatory Options

Regulatory Option	BMP Changes over Baseline
Option 1	Certification of installation of BMPs required for all sites
Option 2	Larger sediment basins and installation certification would be required for all sites
Option 4	Larger sediment basins would be required

Construction Site Models for Sites Larger than 100 Acres

Sites larger than 100 acres were represented by a model construction site of 200 acres. The 200 acre site is assumed to be a composite of two 70-acre model sites, and two 25 acre model sites. While these components do not add up to the full 200 acres (equaling only 190 acres), this small discrepancy is not expected to greatly affect the cost analysis. BMP quantities were estimated by doubling the amounts reported in Tables A-3 and A-5, and then adding.

Table A-7 indicates the changes in BMPs expected for this model site as a result of the regulatory options.

Table A-7. 200 Acre Model Construction Site Changes Due to Regulatory Options

Regulatory Option	BMP Changes over Baseline
Option 1	Certification of installation of BMPs required for all sites
Option 2	Larger sediment basins and installation certification would be required for all sites
Option 4	Larger sediment basins would be required